

UNITED STATES PATENT APPLICATION

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OF

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FOR

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AIR CONDITIONER

5 [0001] This application claims the benefit of the Korean Applications No. P2000-83907 filed on December 28, 2000 and No. P2000-83908 filed on December 28, 2000, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

10 [0002] The present invention relates to an air conditioner which can dispose of condensed water from an evaporator within the air conditioner itself, and improve an air conditioner efficiency.

Background of the Related Art

15 [0003] Referring to FIG. 1, in general, the air conditioner is an apparatus provided with a compressor 1, a condenser 2, a capillary tube 3, and an evaporator 4, for forming a series of refrigerating cycle by subjecting refrigerant to compression at the compressor 1, to isobaric condensing at the condenser 2, to adiabatic expansion at the capillary tube 3, and to isobaric evaporation at the evaporator 4.

20 [0004] In the meantime, there is condensed water formed on a surface of the evaporator 4, for removal of which the air conditioner is provided with additional condensed water disposal device. Though not shown, the condensed water disposal device is, as known, provided with a separate condensed water storage chamber for collecting the condensed water formed at the evaporator 4 and discharge to outside of the air conditioner at fixed intervals.

[0005] However, the condensed water disposal device has the following problem.

25 [0006] Since the condensed water formed at the evaporator 4 is, not disposed of within the air conditioner itself, but drained to outside of the air conditioner, installation and use of the air conditioner have been complicated. That is, there has been a complicity in installation of the air conditioner as a separate drain hose is required for guiding the

5 condensed water formed at the evaporator 4, and a hole is punctured in a wall for passing the
hose, and a complicity in use as re-routing of the hose is required when the air conditioner is
re-positioned.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to an air conditioner that
10 substantially obviates one or more of the problems due to limitations and disadvantages of the
related art.

[0008] An object of the present invention is to provide an air conditioner which can
dispose of condensed water from an evaporator within the air conditioner itself without
discharging to outside of the air conditioner, and improve an air conditioner efficiency.

15 [0009] Additional features and advantages of the invention will be set forth in the
description which follows, and in part will be apparent from the description, or may be
learned by practice of the invention. The objectives and other advantages of the invention
will be realized and attained by the structure particularly pointed out in the written description
and claims hereof as well as the appended drawings.

20 [0010] To achieve these and other advantages and in accordance with the purpose of
the present invention, as embodied and broadly described, the air conditioner includes a
condenser which generates a high temperature heat, an evaporator which absorbs an external
heat, and forms condensed water on a surface thereof by a temperature difference with an
external air, and condensed water self disposal means for transferring the condensed water on
25 the surface of the condenser to a condenser side, and evaporating the condensed water from
the surface of the condenser by the high temperature heat from the condenser, thereby
disposing of the condensed water within the air conditioner itself.

[0011] The condensed water self disposal means may include a guide flow passage

5 for guiding the condensed water formed at the evaporator to a condenser side, and a condensed water spraying unit provided on a side of the condenser for spraying the condensed water guided from the guide flow passage onto the surface of the condenser.

10 [0012] The condensed water self disposal means may require no additional device for transferring condensed water formed at the evaporator to the condenser, but to fit the evaporator over the condenser so that the condensed water falls down from the evaporator to a surface of the condenser by gravity, and evaporates, and disappears by the high temperature heat from the evaporator.

15 [0013] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

20 [0014] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention:

In the drawings:

FIG. 1 illustrates a block diagram of a system of a related art air conditioner;

FIG. 2 illustrates a detail of key parts of an air conditioner in accordance with a first preferred embodiment of the present invention;

25 FIGS. 3A and 3B illustrate details of key parts each showing an operation state of the condensed water spraying means in FIG. 2; and,

FIG. 4 illustrates a detail of key parts of an air conditioner in accordance with a second preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0016] Referring to FIGS. 2 and 4, the air conditioner of the present invention includes a condenser 20 or 220 which generates a high temperature heat, an evaporator 40 or 10 240 which absorbs external heat and forms condensed water at a surface thereof due to a temperature difference with external air, and condensed water self disposal means for transferring the condensed water formed on the surface of the evaporator to the condenser to evaporate the condensed water at the surface of the condenser by the heat from the condenser, thereby disposing of the condensed water within the air conditioner itself.

15 [0017] The condensed water self disposal means in accordance with a first preferred embodiment of the present invention will be explained in detail, with reference to FIG. 2.

[0018] The condensed water self disposal means includes a guide flow passage 50 connected between the evaporator and the condenser for guiding the condensed water formed at the evaporator 40 to the condenser 20, and a condensed water spraying unit 100 for 20 spraying the condensed water guided by the guide flow passage onto a surface of the condenser.

[0019] Preferably, the condensed water spraying unit 100 includes a motor 110 with two degree of freedom over the condenser having a motor shaft 114 for making rotating and linear movement, a heat dissipation fan 120 coupled with the motor shaft for rotating when 25 the motor is in operation, and a pump part 130 at an end of the motor shaft for making a linear movement when the motor is in operation to draw the condensed water through the guide flow passage 50, and supplying the condensed water to an upper part of the heat dissipation fan 120.

5 [0020] First, the motor 110 with two degree of freedom in the condensed water spraying unit will be explained in detail.

[0021] Preferably, the motor 110 with two degree of freedom has a cylindrical stator 111, a linear motion member 112 movably fitted around the stator for making up/down movement relative to the stator 111, a rotor 113 positioned inside of the stator and rotatably 10 supported on the linear motion member 112, and a motor shaft 114 extended from the rotor.

[0022] The stator 111 has rotating motion coil 111a wound adjacent to the rotor 113, and a linear motion coil 111b wound adjacent to the linear motion member 112, and the linear motion member 112 has a magnet 112a in correspondence to the linear motion coil 111b.

[0023] Accordingly, upon application of a power, the rotor 113 and the motor shaft 15 114 are rotated by an electromotive force between the rotor 113 and the rotating motion coil 111a, and the linear motion member 112 and the motor shaft 114 make linear reciprocating motion by an electromotive force between the magnet 112a and the linear motion coil 111b.

[0024] Second, the heat dissipation fan 120 in the condensed water spraying unit is preferably arranged over the compressor 10, and the condenser 20 is preferably bent around 20 the heat dissipation fan 120 and the compressor 10, for precise spraying, evaporation, and disposal of the condensed water supplied to the heat dissipation fan 120 toward the condenser 20 and the compressor 10. It is preferable that a water proof cover 10a is provided on the compressor 10 for preventing infiltration of the condensed water into electric fitting part above the compressor 10.

25 [0025] Third, the pump part 130 in the condensed water spraying unit includes a hollow body 131 connected to the guide flow passage 50 for receiving the condensed water, and having a hole for movably inserting an end of the motor shaft 114, a piston 132 at one end of the motor shaft 114 for making a linear motion with the motor shaft when the motor is in

5 operation for drawing the condensed water from the guide flow passage, and pressing the condensed water in the hollow body 131, and a supply tube 133 for supplying the condensed water to an upper part of the heat dissipation fan 120 by a pressing force of the piston.

[0026] The piston 132 preferably has a through hole (see 132a in FIG. 3A) for passing the condensed water, and a closing member (see 132b in FIG. 3A) for opening/closing 10 the through hole to form a pumping force according to an up/down direction of motion of the piston.

[0027] The closing member 132b may be hinged at a bottom of the piston 132 so that the closing member 132b opens the through hole 132a when the piston 132 moves upward, and closes the through hole when the piston moves downward. In this instance, preferably 15 the guide flow passage 50 is connected to the body 131 at a position higher than a top dead center of the piston 132, and the supply tube 133 is connected to the body 131 at a position lower than a bottom dead center of the piston 132.

[0028] Though not shown, the closing member may be hinged at an upper surface of the piston 132 so that the closing member 132b closes the through hole 132a when the piston 20 132 moves upward, and opens the through hole when the piston moves downward. In this instance, preferably the guide flow passage is connected to the body 131 at a position lower than the bottom dead center of the piston 132, and the supply tube 133 is connected to the body 131 at a position higher than the top dead center of the piston 132. The unexplained reference symbol 30 denotes the capillary tube for expanding the refrigerant.

25 [0029] The operation of the air conditioner in accordance with a first preferred embodiment of the present invention will be explained with reference to FIGS. 3A and 3B.

[0030] The condensed water formed on the surface of the evaporator 40 by a temperature difference with exterior is introduced into the body 131 in the pump part through

5 the guide flow passage 50. As explained, the piston 132 in the pump part makes linear reciprocating movement by the motor 110 with two degree of freedom.

[0031] That is, as shown in FIG. 3A, when the piston 132 moves down, the closing member 132b closes the through hole 132a by inertia, such that the piston 132 pushes out the condensed water to the supply tube 133 as the piston 132 moves down until the bottom dead center.

[0032] Referring to FIG. 3B, when the piston 132 moves up, the through hole 132a is opened by gravity of the closing member 132b and the introduced condensed water, such that the condensed water in the upper part of the body 131 flows down to a lower part of the body 131 through the through hole 132a.

15 [0033] Accordingly, even if the condenser 20 is fitted at a position higher than the evaporator 40, the condensed water formed at the evaporator can be lead toward the condenser.

[0034] Then, as the piston makes linear movement, the condensed water is supplied to an outer circumference of the heat dissipation fan 120 through the supply tube 133, and sprayed in a radial direction of the heat dissipation fan as the heat dissipation fan is rotated by the motor 110 with two degree of freedom which also rotates. In this instance, the condensed water turned into minute droplets by the blades of the heat dissipation fan 120, and sprayed onto a surface of the condenser 20 bent to surround the compressor 10 and the heat dissipation fan 120. At the end, while the condensed water evaporates, and disappears as the condensed water is crashed onto the surface of the condenser 20, the condenser is cooled down by the condensed water, thereby improving a refrigerating efficiency, an air conditioner efficiency. Moreover, when the condenser is fitted in a room, the evaporated water provides an appropriate humidity to the room, to make the room comfortable.

[0035] When some of the condensed water drops down to the compressor 10 during

5 the condensed water is sprayed, the condensed water flows down along the water proof cover 10a on the surface of the compressor 10. Eventually, while the condensed water is evaporated, and disappears from the surface of the compressor which is at a comparatively high temperature (80 ~ 100°C), the refrigerating efficiency, an air conditioner efficiency, is improved as the compressor is cooled down by the condensed water. Moreover, when the 10 condenser is fitted in a room, the evaporated water provides an appropriate humidity to the room, to make the room comfortable.

[0036] A condensed water self disposal means in accordance with a second preferred embodiment of the present invention will be explained, with reference to FIG. 4.

15 **[0037]** The condensed water self disposal means in accordance with a second preferred embodiment of the present invention requires no additional device for transferring condensed water formed at the evaporator 240 to the condenser 220, but to fit the evaporator 240 over the condenser 220 so that the condensed water falls down from the evaporator to a surface of the condenser by gravity, and evaporates, and disappears by the high temperature heat from the evaporator.

20 **[0038]** In this instance, a lower part of the evaporator 240 may be arranged adjacent to an upper part of the condenser 220, or the lower part of the evaporator 240 may be formed as one unit with the upper part of the condenser 220. When the evaporator 240 and the condenser 220 are fabricated as one unit, structure and fabrication of the evaporator 240 and the condenser 220 become very simple, and the condensed water from the evaporator 240 can 25 flow down to the condenser 220 directly, and evaporated and disappears by the high temperature heat from the condenser.

[0039] Preferably, for reducing a possible heat loss between the evaporator 240 and the condenser 220, a refrigerant outlet 220b at the condenser 220, of which temperature is

5 relatively lower than the refrigerant inlet 220a, is positioned on an evaporator 240 side rather than the refrigerant inlet 220a at the condenser 220, as a refrigerant outlet temperature is 40 ~ 50°C while a refrigerant inlet temperature is 60 ~ 80°C. Accordingly, the refrigerating efficiency, the air conditioner efficiency, is improved, and more condensed water is formed at the surface of the evaporator as a temperature difference of the evaporator 240 with exterior 10 becomes greater, which makes the room comfortable as evaporated condensed water provides adequate humidity in the room.

[0040] In order to reduce a possible heat loss between the condenser 220 and the evaporator 240, preferably a refrigerant outlet 240b at the evaporator 240, of which temperature is relatively higher than the refrigerant inlet 240a at the evaporator 240, is 15 positioned on a condenser 220 side rather than the refrigerant inlet 240a at the evaporator 240, as a refrigerant outlet temperature of the evaporator is 10 ~ 15°C while a refrigerant inlet temperature is 8 ~ 10°C. Accordingly, alike above case, the refrigerating efficiency, the air conditioner efficiency, is improved, and more condensed water is formed at the surface of the evaporator as a temperature difference of the evaporator 240 with exterior becomes greater, 20 which makes the room comfortable as evaporated condensed water provides adequate humidity in the room.

[0041] In summary, for doubling the air conditioner efficiency and comfort by efficient reduction of the possible heat loss between the condenser 220 and the evaporator 240, preferably, the refrigerant outlet 220b at the condenser and the refrigerant outlet 240b at the 25 evaporator are formed adjacently.

[0042] Along with this, as a countermeasure for a case when the condensed water from the surface of the evaporator 240 is not evaporated completely from the condenser 220, a condensed water receiver 250 may be provided at a lowest part of the condenser 220 for

5 receiving a small amount of condensed water that is not evaporated yet, when a refrigerant inlet 220a side of the condenser 220 is preferably placed below a level of the condensed water collected in the condensed water receiver 250, for cooling down the condenser 220 and evaporating the condensed water by the high temperature heat from the condenser. The unexplained reference symbol 210 denotes a compressor for compressing the refrigerant, and
10 the reference symbol 230 denotes the capillary tube for expanding the refrigerant.

[0043] The operation of the air conditioner of the present invention will be explained in detail, with reference to FIG. 4.

[0044] As the high temperature refrigerant compressed at the compressor 210 is introduced into the condenser a part of which is submerged in the condenser through the refrigerant inlet 220a at the condenser, the condenser 220 is cooled down by the condensed water, and the condensed water is evaporated by the high temperature heat from the condenser. The refrigerant introduced through the refrigerant inlet 220a at the condenser is involved in gradual temperature drop until the refrigerant flows out through the refrigerant outlet 220b at the condenser, and flows into the capillary tube 230.

20 [0045] The refrigerant, involved in temperature cool down at the capillary tube 230 and introduced into the evaporator 240, is involved in temperature rise as the cooled refrigerant makes heat exchange with flowing air until flows out through the refrigerant outlet 240b at the evaporator, when the condensed water formed at the evaporator 240 flows down to the high temperature condenser 220 below the evaporator 240 by gravity where the
25 condensed water is evaporated, or collected in the condensed water receiver 250, if there is a small amount of the condensed water not evaporated yet, and made to evaporate completely by the high temperature heat at the refrigerant inlet 220a side of the condenser.

[0046] The refrigerant flows out of the refrigerant outlet 220b at the condenser, and is

5 introduced into the compressor 210 again, thereby repeat the cycling.

[0047] It will be apparent to those skilled in the art that various modifications and variations can be made in the air conditioner of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the 10 appended claims and their equivalents.

[0048] The air conditioner of the present invention has the following advantages.

[0049] First, the condensed water formed at the evaporator can be evaporated within the air conditioner itself, requiring no drain hose lead to outside of a room, no puncture in a wall, thereby making installation simple, and an outer appearance good.

15 [0050] Second, the cooling down of the condenser by the condensed water formed at the evaporator can reduce a work of the compressor, that improves an air conditioning efficiency.

[0051] Third, when the condenser, or the compressor is in the room, the adequate humidity from the evaporated condensed water makes the room feel comfortable.

20 [0052] All the advantages of the present invention described in the specification are inclusive.